Test Standard Developed for Determining the Life Prediction Parameters of Advanced Structural Ceramics at Elevated Temperatures

The process of slow crack growth often limits the service life of structural ceramic components. Therefore, it is important to develop a test methodology for accurately determining the life prediction parameters required for component life prediction. In addition, this methodology should be useful in determining the influences of component processing variables and composition on the slow crack growth and strength behavior of newly developed or existing materials, thus allowing component processing to be tailored and optimized to specific needs.

In 1998, the authors initiated the development of a test method to determine the life prediction parameters of advanced structural ceramics at elevated temperatures. Performed at the NASA Glenn Research Center at Lewis Field, the work was done for the C28 Advanced Ceramics Committee of the American Society for Testing and Materials (ASTM). The draft standard written by the authors is going through the required balloting process. We expect it to be established in 2000 as a new ASTM test method, "Standard Test Method for Determining of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Elevated Temperatures," and to be published in the year 2000 Annual Book of ASTM Standards, Vol. 15.01.

Briefly, the test method utilizes constant stress-rate testing to determine strengths as a function of the applied stress rate at elevated temperatures. The merit of this method lies in its simplicity: strengths are measured in a routine manner at four or more applied stress rates through the application of constant displacement or loading rates. The slow crack growth parameters necessary for life prediction are then determined from a simple relationship between the strength and the stress rate.

Glenn has maintained an active leadership role in the standardization of slow crack growth testing of advanced ceramics within ASTM. The authors also wrote a companion ambient-temperature standard, ASTM C 1368–97, "Standard Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics at Ambient Temperature," which has been used by related industry, academia, and government agencies. In addition, Glenn has been actively involved with several international standardization organizations such as the Versailles Project on Advanced Materials and Standards (VAMAS) and the International Energy Agency. In 1988, for example, Glenn participated in a VAMAS round robin on fracture toughness of ceramics, using the Single-Edge-V-Notched Beam method.

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